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FOOD SECURITY, NUTRITION AND COMMERCIALISATION IN SUB-SAHARAN AFRICA – A SYNTHESIS OF AFRINT FINDINGS

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1. INTRODUCTION

While macro-level data as well as sub-sector studies across a number of African countries suggest improvements in agricultural production over the past couple of decades, the extent to which such growth has been based on smallholder production and, as such, has affected smallholder food security and commercialisation is unknown (Wiggins, Keats and Sumberg 2015). The potential for evaluating the possibilities for pro-poor agricultural growth and the commercialisation pathways tied to such growth is hampered by a lack of longitudinal data that traces the evolution of smallholder consumption, food security, nutritional diversity and commercialisation over time. Moreover, while the regional (and sometimes even local) prospects for production as well as commercialisation are reported to vary widely (Wiggins 2000), a regional approach to pro-poor agricultural growth is seldom taken. Finally, although studies of gendered time-use in agricultural production and its nutritional outcomes exist (Johnston et al. 2015), few studies consider the links between food security, gender and pathways of commercialisation. This paper does not therefore focus on production as such, but explores the connection between commercialisation and food security. The analysis is based primarily on descriptive statistics; it does not aim to explore causal relations but rather to assemble data to elucidate changes over time in cross-sectional patterns.

The paper uses data from the Afrint database covering roughly 2,100 smallholders in six African countries: Ghana, Kenya, Malawi, Mozambique, Tanzania and Zambia, surveyed in 2002, 2008 and 2013. It addresses key aspects of food and nutrition security and their linkages to commercialisation. Following a presentation of the data at the country level, regional comparisons will be made, discussing the linkages between food security outcomes and particular commercialisation pathways for the final wave of panel data (2008–13).

2. DATA SOURCES AND LIMITATIONS

The quantitative data used consists of household data collected by the Afrint group[1] in eight African countries in 2002 and 2008 (Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Tanzania and Zambia) and again in six of these countries in 2013/15 (Ghana, Kenya, Malawi, Mozambique, Tanzania and Zambia). The data hence consists of two panel rounds (2002–08 and 2008–13) and three cross sections (2002, 2008 and 2013). The data used in this paper will cover those countries for which data is available for all of the data collection rounds – that is: Ghana, Kenya, Malawi, Mozambique, Tanzania and Zambia.

The original database was collected with the aim to assess the possibilities for an Asian-style Green Revolution in the context of sub-Saharan Africa (Djurfeldt et al. 2005). With this overarching objective in mind, a multi-stage purposive design was used to select countries (and, at a second stage, regions) that were deemed to be above average in terms of agro-ecology and accessibility, but excluding the most vibrant rural economies. Within each country, variability was used as a sampling criterion to select regions, such that each country sample contains regions that are both dynamic and less dynamic. Within each region, villages were again purposively selected and a random sample of the village population was taken. The sample is hence representative at the village level.

A balanced panel design has been used to take into consideration attrition as well as changes in the village populations between the rounds of data collection, hence maintaining representativity between the rounds of data collection. In addition, substantial changes in the village populations between the rounds of data collection in terms of in-migration are addressed through additional sampling of in-migrants specifically. The data set hence contains three groups of respondents: (1) panel households sampled in two years (either 2002 and 2008 or 2008 and 2013) or in all three rounds of data collection (2002, 2008, 2013); (2) households sampled to make up for attrition (sampled in 2008 or 2013); and (3) migrant households that have been added to take into consideration changes in the composition of the village population, either in 2008 or 2013.

The ambitions as well as the quality of the data have evolved over the project cycles: the 2002 data focused on production and technology related to the major grain crops (rice, maize, sorghum, teff) and cassava, whereas the 2008 survey added a more detailed section on commercialisation and also collected cash income data for the first time. Data on transfers of food outside the co-resident household was also collected in 2008. For the final round of data collection, cash income data was individualised, with data being collected separately for all adult household members.

2.1 What the data can tell us and what it can't

While the Afrint data set is unique in the sense that it captures changes in rural livelihoods over time, several caveats need to be borne in mind: firstly, it is representative at the village level and as such is not nationally representative of smallholders in each country as a whole. Conclusions therefore cannot be drawn about general improvements in food security, for instance. Secondly, the data set has not aimed to collect the detailed type of production data found in agricultural surveys collected by Michigan State University (for instance), nor does it provide the detail commonly found in consumption surveys (such as demographic health surveys). Rather, the data set provides a set of broad indicators capturing changes in food security status, nutritional diversity and commercialisation.

A final drawback relates to the use of the household as the sampling unit, which is problematic for several reasons. These are related both to assumptions of theory (and the associated presumption of a joint utility function) and methodology (assuming that the household head[2] has perfect information and can speak on behalf of the household). From a gender perspective, the data is especially problematic since the food security data does not, for instance, shed light on the well-documented phenomenon of secondary poverty and food insecurity found among girls and women in households that prioritise the dietary needs of boys and men (Sen 1990).

Bearing these constraints in mind, a number of indicators will be used to address the research gaps outlined above. Cross-sectional data (using the cross-sections for 2002, 2008 and 2013) will be used to trace changes in food security and nutritional diversity for the sample population as a whole since 2002. This provides a description of the ***status*** of food security in the sample at these points in time. To capture causal relations, however, panel data is necessary and data on commercialisation pathways based on data for the final panel (2008 and 2013) respectively will be used to discuss the gender and distributional dynamics of who is involved in particular commercialisation pathways, as well as their outcomes in terms of food security and welfare.

2.2 Cross-sectional descriptive data

Aspects of ***food security*** will be addressed on the basis of consumption data for the major grain crops (maize, rice and sorghum) as well as in-kind transfers of grains leaving the household (where data is available for 2008 and 2013), enabling the possibility of controlling for consumption that occurs outside the co-resident household unit. The reciprocity of such linkages is analysed through data on cash remittances as well as the existence of in-kind transfers into the rural household.

Changes in ***nutritional diversity*** will be captured through data on purchases of animal source foods (milk, meat, fish) and household access to livestock. General food security status will be examined through data on the number of meals eaten during the lean season, where data is available for 2008 and 2013, and whether the household reduces the quality of meals eaten during the lean season (2013).

2.3 Panel data

Five commercialisation pathways will be constructed on the basis of panel data tracing the relative change in share of incomes raised from the sale of particular types of agricultural produce, also considering households that have not commercialised during the period. Since data on cash income is not available for the 2002 round of data collection, only data from the final panel round (2008 to 2013) will be used.

Five key commercialisation pathways are considered for this panel wave: increased commercialisation in staple crops; other food crops; non-food cash crops; and animal products. A final pathway concerns households that have not followed either of these commercialisation pathways. The analysis will consider who is involved in these pathways (in terms of gender and position within the village land distribution) as well as the outcomes of commercialisation in terms of food security (number of meals eaten in lean season) and welfare (enhanced ability to save).

3. GRAIN CONSUMPTION

The data on grain consumption covers data on the amount of production devoted to household consumption for maize, rice and sorghum. For the 2002 and 2008 data collection rounds, the grains produced by the household have been classified into four categories: home consumption, payment for hired labour, sale, and other uses (seed, animal feed, brewing, gifts, storage losses, etc.). For rice, the data on paddy has been converted into rice equivalents using a conversion factor of 0.68, whereas the data on maize and sorghum is presented as grain equivalents. The assumption is that when turned into meal for consumption, rural households use the grain as a whole – an assumption that has been confirmed as correct by the data collection teams in each country.

The level of detail of the data varies between the years: in 2002, separate data on transfers of food to feed family members in other locations was not collected. During the course of qualitative fieldwork in Kenya (see Andersson Djurfeldt 2012; Andersson Djurfeldt and Wambugu 2011) it became clear that respondents viewed such transfers as part of the consumption burden of the rural household, even though consumption was occurring elsewhere. As such, it is likely that food transfers inflate the consumption data for 2002, but since data on food transfers was not collected for 2002 it is not possible to take these transfers into consideration. For the 2008 round of data collection, a separate section on grain transfers was added, but the issue of food transfers has been dealt with differently in the various countries, with some enumerators listing them as 'other' and others classifying them as home consumption in the breakdown of the many uses of maize produced by the household. For 2008, rather than use the data on home consumption, the amount of grain retained has been calculated. Grain retained has been calculated as the total household production of grains, less transfers, less sales, less payment for labour and hence includes the residual category of 'other'. Since it was not possible to assess whether transfers were included in the household consumption figures, this was the best way to deal with this incertitude. This again may inflate the amount of grain available for household consumption, but less so than for 2002. For 2013, transfers were added as a distinct category in the list of grain uses, and hence data on household consumption is not confounded by the inclusion of consumption occurring outside the co-resident household.

The data presented in Table 1 thus contains data on home consumption of grains (inflated by transfers) for 2002, data on grains retained for 2008 (excluding transfers, but including 'other' uses) and 'pure' home consumption data for 2013. To take into consideration the size and demographic composition of the household, data has been divided by the number of adult equivalents in the household.[3]

Table 1: Mean grain consumption per adult equivalent, by country, 2002 to 2013, for households that produced and consumed grains

Country	2002	2008	2013	Diff 2002 - 2008	Sig.	Diff 2008 - 2013	Sig.
Ghana	45	31	52	-13	***	20	***
Kenya	61	53	65			12	*
Malawi	157	183	165	26	**	-17	*
Tanzania	152	166	217			51 ***	***
Zambia	123	170	179	47	***		
Mozambique	59	88	106	29	***	18	**
Total	102	106	131	4		25	***

Notes: Extreme cases have been removed by country; 'total' refers to the average for the full sample.

Bearing in mind the shortcomings of the data (suggesting inflated figures both for 2002 and 2008) points to improvements in food security in the first period, especially for three of the six countries (Malawi, Zambia and Mozambique), but sustained improvement only in Mozambique. During the second period (2008 to 2013) four countries experienced rising grain consumption, but with the exception of Tanzania, increases were quite small. In the case of Ghana and Kenya, the data collection sites explain the low consumption figures, since half of the villages are located in regions unsuitable for grain production (Nyeri in Kenya, and Eastern region in Ghana). Dietary patterns are more varied in these regions, relying to a larger extent on roots and tubers, such as Irish potatoes and cassava.

It should be noted that by 2013, grain-producing households on average fulfilled the annual consumption standard (set by the Food and Agriculture Organization of the United Nations, FAO) of 117kg per adult equivalent, suggesting that grain producers are, on average, food secure.

Data on median grain consumption qualifies some of the tendencies found in mean consumption; although sustained improvements in mean consumption were noted only for Mozambique, median consumption rose in all countries throughout the period, except for Malawi (see Table 2). Although the median is lower than the mean in all countries at all points of data collection, the distribution of grain consumption has improved in four of the countries, the exceptions being Ghana and Mozambique. In the remaining countries, the median as a share of the mean has increased, albeit in the case of Malawi as a result of falling mean consumption. In the case of Zambia and Tanzania, median consumption fell short of mean consumption by 15 percent or less. In turn, this suggests that grain consumption increases have disproportionately benefited the less food secure half of the sampled population.

Table 2 Median amount of grain production devoted to home consumption per adult equivalent, 2002 to 2013

Country	2002	2008	2013
Ghana	33	22	40
Kenya	40	34	45
Malawi	121	159	145
Tanzania	126	119	185
Zambia	93	138	154
Mozambique	50	65	71

4. GRAIN TRANSFERS

While the data on home consumption suggests that households on average are food secure and that distribution of grain consumption has become more even over time, the data on transfers also points to a growing dispersal of consumption across geographical areas. Many more households transferred grains in 2013 than in 2008 – with the share of producers who reported transferring grains increasing from 39 percent in 2008 to 61 percent in 2013.

While the number of households involved in transfers increased, the average size of transfers remained largely unchanged, except for in Tanzania where, as Table 3 shows, households on average remitted 213kg of grains in 2013 compared with 101kg in 2008. In absolute terms, the largest transfers of grains were found in Zambia, where the mean size of transfers was 297kg in 2013. In both these countries, the median rose considerably, but in proportion to the mean, the gap narrowed only in Zambia, where the median transfer increased by 100kg between 2008 and 2013.

Table 3 Mean and median size of grain transfers to relatives outside the village per household, 2008 and 2013 (kg), for households that transferred grains

Means					Median	
Country	2008	2013	Diff 2008 - 2013	Sig.	2008	2013
Ghana	57	94	37 ***	***	50	67
Kenya	124	124	-1		90	90
Malawi	110	124	14		100	100
Tanzania	101	213	112	***	72	133
Zambia	248	297	48		150	250
Mozambique	62	101	39	***	50	75
Total	104	150	46	***	62	100

Note: 'Total' refers to the average for the full sample.

Overall, the data suggests a wider dispersal of grains produced by the household, for consumption outside the villages, compared with 2008. Using the FAO food security cut-off point of 117kg for grain consumption, it can be noted that the households in Kenya, Malawi, Tanzania and Zambia on average supported at least the equivalent of one additional adult outside the co-resident household, in effect increasing the consumption burden of the production unit by one adult equivalent. In the case of Zambia, even the median household supported more than the equivalent of two adult household members outside the village.

In the anthropological literature, there is a long-standing theoretical engagement with the presumed reciprocity of gifts in general (Mauss 1925). More recently, such perspectives have been questioned by studies related to household and kin structures (Guyer 2014; Guyer 1981), as well as geographical perspectives on multi-local livelihoods (Andersson Djurfeldt 2014; Frayne 2010). Earlier work based on the Afrint data from 2008, as well as qualitative work in Malawi (Andersson 2011), Kenya and Ghana, suggests that transfers are part of a spatialised system of food sharing arrangements and, as such, are not based on expectations of reciprocity in cash or in kind.

For 2008, there were small signs of reciprocal relations based on exchanging food for cash remittances: 19 percent of the households that transferred grains received cash remittances, compared with 16 percent of those households that produced grains but did not engage in transfers. For 2013, the share of transferring households that received cash remittances had

increased to 24 percent, while the corresponding share among the households that did not transfer grains had dropped to 16 percent, possibly suggesting the growing importance of reciprocal relations in family-based support systems. On the whole, incoming cash remittances have become slightly more common since 2008, when 17 percent of all sampled households received cash remittances, compared with 22 percent in 2013. Together with the growing occurrence of food transfers, this suggests an increasing multi-locality of rural livelihoods and rising mobility (whether to rural or urban areas).

In 2013, data on incoming in-kind transfers was collected for the first time. This data also points to reciprocal relations of support: 36 percent of the households that transferred grains to their relatives received in-kind transfers from relatives, compared with 27 percent of the households that produced grains but did not transfer grains to relatives. The most common items received among households in the first category were clothes (63 percent) and food (59 percent). For those households that did not transfer grains, the order of magnitude was reversed, with food being the most frequently mentioned item (72 percent) and clothes (63 percent) the second. Around a quarter of households in both groups (24 and 28 percent respectively) received farm inputs.

On the whole, the data attests to the considerable spatialiaty of rural livelihoods, showing on the one hand the physical separation of the units of production and consumption and, on the other, the importance of incoming transfers of both cash and goods in kind.

5. GENERAL FOOD SECURITY INDICATORS

Although the large majority of households produce grains, the variation in dietary patterns and the regional reliance on roots and tubers especially as alternative staple crops suggest that data on grain consumption alone cannot be used to address aspects of food security. In the 2008 round of data collection, a variable was introduced detailing the number of meals eaten in the regular as well as the lean season and in 2013 a question was added on whether households reduced the quality of foods.

While the grain consumption data suggested that grain consumption had increased, especially in Tanzania and to a lesser extent in Mozambique, the data on meals eaten moderates the impression of improved food security considerably (see Table 4). While the number of meals eaten was unchanged or increased in all other countries (albeit from low levels), food security by this measure decreased in Tanzania, with both the mean and median number of meals declining. Of the six countries, Malawi is the least food secure. For the sample as a whole, there was a slight improvement in the average number of meals eaten daily during the lean season, increasing from 2.31 to 2.36 meals.

Nonetheless, around half of the households (53 percent) reported reducing the number of meals eaten during the lean season, whereas slightly more (61 percent) reduced the quality of food eaten. However, there was considerable variation from country to country. Malawi by this token is the most food insecure, with 72 percent of households reducing the number of meals eaten, and 83 percent reducing the quality of food. In Kenya, by contrast, 37 percent of households reported limiting the number of meals eaten, although two-thirds reduced the quality of food.

Recapitulating the food security data suggests minor improvements in grain consumption for both periods (2002–08 and 2008–13) for the sample as a whole, as well as a rise in the average number of meals eaten during the lean season.

Table 4 Number of meals eaten in the lean season, 2008 and 2013

Mean					Median	
Country	2008	2013	Diff.	Sig.	2008	2013
Ghana	2,59	2,54	-0,06		3	3
Kenya	2,56	2,62	0,06		3	3
Malawi	1,87	1,89	0,02		2	2
Tanzania	2,69	2,38	-0,31	***	3	2
Zambia	2,07	2,44	0,37	***	2	2
Mozambique	2,03	2,29	0,27	***	2	2
Total	2,31	2,36	0,05	*	2	2

Note: 'Total' refers to the average for the full sample.

6. INDICATORS OF NUTRITIONAL DIVERSITY

While food security data suggests that the availability of food has increased, an indication of the dietary diversity of the sampled households can be provided by the data on access to animal source foods, either through purchase or rearing own livestock. The ideal would, of course, have been to have data on food consumed, but this data is not available; the variables therefore give only a rough estimate of the nutritional diversity found at household level.

6.1 Purchase of animal source foods

Data on purchases of milk, meat and fish is available for all three years. In 2008 eggs were added, but I have chosen to use the data for the foods that were available throughout. A major shortcoming of the data is that it only addresses whether households have been able to purchase these foods at some point during the past year.

This indicator is clearly too roughly hewn to provide a meaningful estimate of nutritional diversity: purchase of any animal source food (milk, meat and fish) was nearly universal throughout the period, with 96 percent of households purchasing one of the three products in 2002 and 2008 and 97 percent in 2013. The ability to purchase all products – although not a perfect measurement – can provide a more nuanced indicator. Dietary diversity when measured as the share of households who purchased all three products increased slightly throughout the period, from 42 percent in 2002 to 50 percent in 2013.

6.2 Tropical livestock units

An alternative to purchasing animal source foods is to keep livestock. The data collected is broadly comparable over the years, although more specific categories were added in 2008 and 2013. The data has been converted into tropical livestock units (TLUs) following Jahnke et al. (1988). Unfortunately, due to a data coding error, it is not possible to use the Mozambique sample for livestock for 2013.

While the number of extreme cases removed for the previous variables has been below 50, it must be noted initially that livestock ownership is highly skewed, with 86 extreme cases removed in 2002 and as many as 97 for the 2013 data. Extreme cases were removed at the village level since livestock holding patterns are highly differentiated in spatial terms, with a great deal of variation intra-regionally.

On average, the number of TLUs has increased in both periods (see Table 5), but as expected there are large differences between countries both in the number of livestock as well as the size of these increases. In Zambia, herds have rebounded from a severe outbreak of East Coast fever in 2002 and have grown steadily since then. While livestock is (relatively speaking) more important in Zambia, Kenya and Ghana (and even more so if intra-country regional differences are considered), the large discrepancy between average and median ownership suggests that access to livestock is not likely to play a decisive role in nutritional diversity for smallholders as a whole.

Table 5 Tropical livestock units, 2002, 2008, 2013

Mean								Median	
Country	2002	2008	2013	Diff. 2002 - 2008	Sig.	Diff. 2008 - 2013	sig.	2008	2013
Ghana	1,52	1,57	2,04	0,05		0,47		0,70	0,60
Kenya	2,04	2,03	2,33	-0,01		0,30		1,56	1,74
Malawi	0,26	0,45	0,35	0,19	***	-0.10		0,10	0,10
Tanzania	0,18	0,49	0,57	0,31	***	0,07		0,18	0,10
Zambia	1,22	2,52	4,22	1,30	***	1,71		0,50	0,90
Mozambique	0,52	0,56		0,05				0,10	
Total	0,92	1,29	2,01	0,36	***			0,38	0,44

Notes: For the second period it is not possible to test the difference in TLUs since Mozambique was not covered by the sample in 2013, and the 2008 sample therefore differs from the 2013 sample; 'Total' refers to the average for the full sample.

7. REGIONAL COMPARISONS

The basic food security indicators (amount of grains consumed per adult equivalent and the number of meals eaten during the lean season) point to limited improvements in food security for the sample over time. It is possible to assess any spatial disparities in such increases by disaggregating the data by region (Table 6).

As reported earlier, at the country level, only Mozambique showed a sustainable increase in the volume of grain production set aside for domestic consumption. In the case of Tanzania, as shown in Table 6, the regional difference found in 2002 has gradually reduced over time, whereas in the case of Mozambique, consumption improvements in the Central and South regions have marginalised the North. For Zambia, regional differences that emerged during the second panel period disappeared between 2008 and 2013. In Malawi, similarly, the gains made in Bwanje Valley and the Shire Highlands between 2002 and 2008 were offset during the final panel period, reducing spatial disparities in consumption, but doing so at the cost of lower consumption in general. While the physical geography of the two Kenyan regions assigns a very different role to grains (and maize especially) in production patterns, the changes in consumption over time are small. Finally,

Table 6 Mean amount of grain production devoted to home consumption per adult equivalent, 2002, 2008, 2013, by region

Country	Region	2002	2008	2013	Diff 2002 - 2008	Sig.	Diff 2008 - 2013	Sig.
Ghana	Eastern	35	38	42	3		4	
	Upper Eastern	55	26	60	-29	***	34	***
Kenya	Kakamega	87	75	86	-12		11	
	Nyeri	39	34	43	-6		9 *	
Malawi	Ntchisi RDP	214	174	183	-40		9	
	Thiwi Lifidzi	138	137	169	-1		32	*
	Bwanje Valley	129	193	127	64	***	-66	***
	Shire Highlands	147	229	183	82	***	-46	*
Tanzania	Morogoro	128	152	217	24		65	**
	Iringa	172	182	216	10		34	
Zambia	Mkushi	117	134	167	16		33	***
	Mazabuka	129	222	193	93	***	-29	*
Mozambique	North	46	66	66	20	***	0	
	Centre	71	115	134	44	***	19	
	South	57	51	135	-6		83	***
	Total	102	106	131	4		25	***

Note: 'Total' refers to the average for the full sample.

in the case of Ghana, the increase in grains devoted to own consumption is concentrated to the Upper Eastern region, which is not surprising given its reliance on tree crops and cassava.

In terms of general food security (as measured through the number of meals eaten during the lean season), regional disparity decreased in Ghana, but this was the result primarily of decreasing food security in the Eastern region (see Table 7). In Kenya, the gap between Nyeri and Kakamega regions widened despite the lower amounts of grains used for home consumption in the former region, which, given the prevalence of maize in local diets, suggests that food security is improved mainly through increased ability to purchase maize. In Malawi, lean season food security is especially low, with the four regions found at the bottom of the sample. Only Thiwi Lifidzi showed a marginal improvement in the number of meals eaten since 2008.

Table 7 Mean number of meals eaten during lean season, 2008 and 2013, by region

Region	2002	2008	Diff 2008-2013	sig.
Eastern	2,89	2,67	-0,22	***
Upper Eastern	2,31	2,42	0,11	*
Kakamega	2,43	2,43	0,00	
Nyeri	2,69	2,80	0,11	*
Ntchisi RDP	1,76	1,83	0,07	
Thiwi Lifidzi	1,80	2,06	0,26	
Bwanje Valley	1,95	1,85	-0,10	
Shire Highlands	1,99	1,84	-0,15	
Morogoro	2,73	2,38	-0,35	***
Iringa	2,65	2,38	-0,28	***
Mkushi	1,90	2,41	0,51	***
Mazabuka	2,32	2,48	0,16	*
North	2,03	2,20	0,17	**
Centre	2,17	2,49	0,32	***
South	1,72	2,09	0,36	***
Total	2,31	2,36	0,05	*

Note: 'Total' refers to the average for the full sample.

In Tanzania, despite the improvements noted in grain consumption, food security fell in both regions, erasing the difference in the number of meals eaten in the lean season found in 2008. Zambia and Mozambique, by contrast, both show improvements in food security across all regions, although in both countries the starting point for such improvements was low.

There are very minor regional differences in purchase of animal source foods (as there are at the country level). Moreover, the purchase of animal source foods does not vary between the different periods. For TLUs, by contrast, there are distinct regional dynamics.

As demonstrated in Table 8, livestock ownership is limited throughout the sample, yet there are clear regional differences. One exception stands out – Mazabuka region in Zambia, where herds have been restocked (as noted earlier).

While there are fairly large national differences in the share of households that reported reducing the quality of meals eaten in the lean season, the regional differences are much smaller: only two countries (Ghana and Mozambique) have large regional disparities. Here, the share of households reducing the quality of meals eaten was more than twice as high for one region compared with the other(s) – with 71 percent of households reducing the quality of meals eaten in the Upper Eastern compared with the Eastern region in Ghana, and 87 percent of households in Mozambique's North region reducing the quality of meals eaten compared with 40 percent in the Central region.

The regional dynamics of food security are somewhat contradictory; differences in grains withheld for own consumption can largely be explained by variations of production and diets, whereas statistically significant differences in the numbers of meals eaten in the lean season are found in Ghana, Kenya, Malawi and Mozambique. Such differences are especially large in Kenya and Mozambique, where the difference between the most and least food secure regions is around 0.4 meals. In general, however, the regional dynamics of food security are less pronounced than might be expected given the purposive sampling of the households by region.

Table 8 Mean number of household TLUs by region, 2002, 2008 and 2013

Country	Region	2002	2008	2013	Diff 2002 - 2008	Sig.	Diff 2008 - 2013	Sig.
Ghana	Eastern	0,29	0,48	0,31	0,20	***	-0,17	***
	Upper Eastern	2,70	2,62	3,46	-0,08		0,84	**
Kenya	Kakamega	2,63	2,25	2,36	-0,38		0,11	
	Nyeri	1,44	1,82	2,29	0,38	**	0,48	*
Malawi	Ntchisi RDP	0,44	0,63	0,49	0,18		-0,14	
	Thiwi Lifidzi	0,21	0,25	0,43	0,04		0,19	*
	Bwanje Valley	0,29	0,63	0,23	0,34	**	-0,40	**
	Shire Highlands	0,11	0,29	0,23	0,18	***	-0,06	
Tanzania	Morogoro	0,07	0,16	0,13	0,09	***	-0,03	
	Iringa	0,30	0,79	1,01	0,50	***	0,21	
Zambia	Mkushi	0,49	0,57	0,98	0,08		0,42	***
	Mazabuka	2,02	5,15	7,99	3,13	***	2,84	***
Mozambique	North	0,26	0,20		-0,06			
	Centre	0,34	0,27		-0,08			
	South	1,52	1,87		0,35			
	Total	1,00	1,29	2,01	0,29	***		

Note: 'Total' refers to the average for the full sample.

8. GENDER DYNAMICS

I turn now to the gendered patterns of food security and nutritional diversity. As observed earlier, the data is not able to shed any light on intra-household patterns of food consumption and hence the analysis is limited to comparing food security status between households depending on the sex of the head of household.

As suggested by Table 9, the amount of grain used for own consumption has increased in the final period for both male- and female-headed households. There were no statistically significant differences in consumption between 2002 and 2008.

Table 9 Mean amount of grain devoted to household consumption per adult equivalent, by sex of head of household, 2002, 2008 and 2013, for households producing grain

Sex of Head of Household	2002	2008	2013	Diff. 2008	Sig.
Male	104	106	134	28	***
Female	96	106	122	16	**

While food security by this measure has improved for both household types, the gap between the two has widened: whereas there were no statistically significant differences in amounts of grains consumed either in 2002 or 2008, the difference in 2013 was significant at the 5 percent level.

Table 10 Mean number of meals eaten in lean season, by sex of head of household, 2008 and 2013

Sex of Head of Household	2008	2013	Diff. 2008 - 2013	Sig.
Male	2,35	2,39	0,05	*
Female	2,72	2,28	0,06	

The number of meals eaten in the lean season also increased, but this rise was statistically significant only for male-headed households. There was a statistically significant gender gap in both years (significant at the 0.1 percent level), pointing at persistently poorer food security in female-headed households. This gender gap was reaffirmed with respect to reductions in the quality of food eaten: 66 percent of female-headed households stated that they reduced the quality of food eaten in the lean season compared with 60 percent of male-headed households – a difference of 6 percent (statistically significant at the 1 percent level).

With respect to nutritional diversity, the data is more mixed, with the figures on purchased animal source foods pointing in one direction and ownership of livestock in the other.

Table 11 Share of households that purchased all three animal source food products (meat, milk, fish) over the past year, by sex of head of household

Sex of Head of Household	2002	2008	2013	2002 -2008	Sig.	2013 - 2008	Sig.
Male	0,45	0,46	0,51	0,01		0,05	**
Female	0,36	0,43	0,48	0,06	*	0,05	

For the sample as a whole, the purchase of one of the animal source foods (milk, meat or fish) was nearly universal, whereas having bought all three was less common. As with grain consumption, the data on animal source foods showed improvements for both male- and female-headed households since 2002 (see Table 11). In contrast to the grain consumption data, however, the difference between the two household types was statistically significant during the first round of data collection, but this difference disappeared in 2008. Using this indicator as a measurement of nutritional diversity suggests that the gender gap has narrowed rather than widened with respect to purchased animal source foods.

In terms of ownership of livestock the expectation is that this is dominated by male-headed households – a relationship which also emerges in the data. The unequal distribution of livestock noted earlier has a clear gender dimension, with female-headed households on average holding less than half the number of TLUs

than their male-headed counterparts in the final data collection round. Indeed, the gender gap has widened continuously, but especially between 2008 and 2013. The gender-based differences are statistically significant at the 0.1 percent level for all years of data collection (Table 12).

Table 12 Mean ownership of livestock in TLUs by sex of head of household, 2002, 2008, 2013

Sex of Head of Household	2002	2008	2013	Diff. 2002 - 2008	Sig.
Male	1,04	1,43	2,36	0,38	***
Female	0,67	0,93	1,06	0,26	**

Note: The difference for 2008 to 2013 is not possible to use since the 2013 sample excludes Mozambique.

The data on nutritional diversity hence points in opposite directions, and given the crudeness of the data on purchased animal source foods (which pre-empts any meaningful attempt to estimate volumes consumed), ownership of livestock appears to give a much more reliable approximation of nutritional diversity.

While it was noted that there are fairly minor regional differences in food security and nutritional diversity, the gender-based differences are stronger and have also become more pronounced over the panel periods. Whereas food security improvements generally have benefited both male- and female-headed households, the former have gained disproportionately with the gender gaps increasing rather than decreasing over time. In terms of nutritional diversity, this tendency is particularly pronounced for ownership of livestock.

9. COMMERCIALISATION PATHWAYS

Commercialisation implies a process of change in which farmers increasingly engage with output markets. A measurement of commercialisation hence can depart, for instance, from production itself, where an increase in the share of production sold would imply increasing commercialisation. The drawback of this indicator is that it does not take into consideration differences in cropping patterns, and the problems of estimating weights for roots and tubers especially. For the data set, volumes of sale are available only for maize, rice and sorghum, limiting the possibility for addressing other types of commercialisation on this basis. Another option is to consider market entry and exit, but this says nothing about levels of commercialisation, for which data is available for a number of crops. This data has been analysed elsewhere addressing aspects of gender and commercialisation (Andersson Djurfeldt 2016).

An alternative measurement departs from the cash incomes received (rather than the volumes or shares sold) by the farmer. The disadvantage of this method is that comparison across countries effectively requires sub-dividing the country-wide sample into a variety of commercialisation pathways (meaning very small sub-country samples) to deal with differences in prices. Furthermore, accounting for changes in exchange rates, purchasing power and inflation over time can play tricks on the value of sales, hampering country-wide comparison while country-level differences in purchasing power parity may not be relevant to largely insular rural economies.

A further alternative is therefore to look at the relative importance of different crop types for the composition of cash incomes and how this has changed over time, and explore empirically *who* is involved in the various commercialisation pathways in terms of gender and income distribution – is it poor people, rich people, women or men?

The advantage of this approach is that the *relative* importance of particular pathways can be identified, and linked to certain types of farmers. The increasing importance of other sources of income (including sources outside agriculture) will, however, supress the commercialisation tendency for remaining income sources, including specific pathways of commercialisation. Given the data structure and the relatively small country samples, nonetheless, I opt for using changes in share of income raised from particular farm-based sources of income. Importantly, this excludes the households who did not generate any cash income either in 2008 (113 households) or 2013 (118 households), which are arguably the poorest households in the sample.

As stated initially, cash income data does not exist for 2002, but the data from 2008 and 2013 allows for the creation of four pathways of commercialisation: (1) an increasing share of income raised from the ***sale of staple crops;*** (2) an increasing share of income raised from the ***sale of cash crops;*** (3) an increasing share of income raised from the ***sale of other food crops;*** and (4) an increasing share of income raised from the ***sale of animal produce.***

Between 2008 and 2013, 738 households (or 39 percent) increased the share of income raised from staple crops, 797 households (42 percent) increased the share raised from other food crops, 347 (18 percent) had a higher share of income sourced from cash crops, and 524 (27 percent) increased the share of income from animal products. Around a fifth of the households (21 percent) did not increase commercialisation at all. This latter category includes both those households who decreased commercialisation as well as those who remained commercialised at the same (and potentially high) levels. As such, this group may combine both households that were highly commercialised throughout but did not increase their income from agriculture relative to other sources, as well as those who withdrew from output markets. Nonetheless, the distributional make-up of this pathway is also worth considering, and will be discussed below as ***stagnant commercialisation.***

The most common pathway of commercialisation was within other food crops, whereas non-food cash crops was the least frequent pathway. It is important to stress

that commercialisation pathways are interchangeable, with households likely to shift in and out of them as opportunities change: 43 percent of the households increased commercialisation only in one market and 29 percent engaged in two commercialisation pathways. A small minority were involved in three pathways or more (15 percent).

To address the issue of ***who*** is involved in the various pathways, I use a set of bivariate correlations to check for correlation against a set of dummy variables pertaining to the situation in 2008: sex of farm manager, and whether the household belonged to the lowest village quintile in terms of cultivated area. Two variables tracing changes over the period capture the ***welfare outcomes*** of each pathway: increases in number of meals eaten during the lean season, and improved ability to save (whether the household could save in 2013 but not in 2008).

Clearly, other variables are more important in explaining commercialisation ***per se***, but the focus of this exercise is to shed light on who is involved in respective pathways and whether commercialisation entails improvements in livelihoods, rather than to understand commercialisation dynamics as such. Bivariate correlations carry the risk of collinearity and the results must be seen as indicative and a preliminary way of treating the data. In the long run, it is more desirable to construct a multivariate model to explore and explain the different commercialisation pathways with respect to causal dynamics related to production and inputs of labour, land and technology, but that is beyond the scope of this paper.

9.1 Commercialisation in staple crops

The income data on staple crops covers grain crops as well as roots and tubers – some of which have traditionally been considered women's crops or crops grown by poor farmers. As pointed out elsewhere (Andersson Djurfeldt 2016), this relationship does not generally hold with respect to the Afrint data, with farmers responding to particular commercial opportunities as they arise, regardless of gender.

The bivariate correlations between the variable on sex of head of household as well as the distributional indicator used (whether households belonged to the bottom village quintile in terms of cultivated land size) suggest that staple crop commercialisation does not discriminate against either of these groups: there are no statistically significant correlations between these variables and having increased commercialisation. For the outcome variables (improvement in ability to save and improvements in lean season food security), likewise there are no statistically significant correlations with commercialisation in staple crops. In sum, therefore, increased commercial engagement in output markets for staple crops appears to cut across factors of distribution and gender and is not associated with improvements in the two variables used to measure welfare outcomes.

9.2 Commercialisation in other food crops

The correlations for other food crops show the same tendencies as the data on staple food crops: there are no significant correlations between commercialisation in food crops when it comes to sex of head of household, land distribution or either of the outcome variables. Again, it appears that markets do not discriminate against women or poor farmers, but also that commercialisation pathways do not provide for improved welfare outcomes.

9.3 Commercialisation in non-food cash crops

By contrast, for non-food cash crops, there is a minor negative correlation of -0.064 (significant at the 1 percent level) for households belonging to the bottom quintile of the village land distribution. Somewhat surprisingly, given the marketing structure of many of the output markets for traditional cash crops such as tobacco and cotton, female-headed households are not excluded from these pathways of commercialisation.

In terms of outcomes, the cash crop commercialisation pathway is connected to poorer food security: there was a slight negative correlation (-0.046 *) for increases in cash crop commercialisation. However, improvements in ability to save were unrelated to this type of commercialisation.

9.4 Commercialisation in animal products

Given the strong gender bias in TLUs it is surprising that the animal products commercialisation pathway does not exclude female-headed households. The explanation for this may be that women sell small stock and eggs, for instance, and that female-headed households in general have lower incomes than male-

headed households. In turn, this means that even small increases in the sales of animal products increase commercialisation in female-headed households. As with cash crops, there is, however, a small negative correlation (-0.059 *) between belonging to the bottom land quintile and this commercialisation pathway. Neither of the outcome variables is correlated with increased commercialisation in animal products.

9.5 Stagnant commercialisation

The final pathway consists of households that did not increase their commercialisation between 2008 and 2013. This pathway is positively correlated with households that were headed by women in 2008 (0.085**), but not with being part of the lowest land distribution quintile in the same year. Neither of the outcome variables is correlated with this pathway either.

9.6 Commercialisation pathways and the (lacking) linkages to food security improvements

Summing up, there are few signs that the commercialisation pathways based on food crops (either staples or other food crops) exclude either poor famers or women. For non-food cash crops and animal products, belonging to the bottom quintile of the village land distribution leads to a slight negative correlation with increases in commercialisation. However, not having commercialised at all is positively correlated with being a female-headed household, pointing to an exclusion from agricultural markets in general among female-headed households.

Perhaps most disconcerting is the lack of any positive correlation between any of the commercialisation pathways and improvements in lean season food security and ability to save. Indeed, the only correlation between any of the commercialisation variables and the outcome indicators is poorer food security among households that increased their engagement in cash crop commercialisation, linking to a long-standing discussion on food security among cash crop cultivators (Anderman et al. 2014; Von Braun 1995).

Earlier work on the first panel (2002-08) shows the importance of commercialisation as a driver of intensification in grains (Andersson Djurfeldt and Djurfeldt 2013), and work in progress again demonstrates the importance of market entry and increased commercialisation as a driver of production for the second panel wave (Andersson Djurfeldt et al. 2018). Commercialisation pathways were also forthcoming in the sample: nearly 80 percent of the households reported increased shares of incomes raised from one or more crop types. The Agricultural Policy Research in Africa (APRA) synthesis on gender and commercialisation (Andersson Djurfeldt 2016) also illustrates generally high levels of market participation and engagement with markets in the second period. Here it was found that gender-based differences in commercialisation are tied primarily to lower levels of surplus production that can be used for sale rather than the discrimination of markets ***per se.*** The results on commercialisation pathways confirm the notion that income composition for male- and female-headed households are largely similar and, as such, market engagement is restricted by available surplus rather than by markets. Similarly, the commercialisation patterns of poor farmers largely appear to follow those of wealthier farmers.

Whereas commercialisation is forthcoming, the link between commercialisation and improvements in food security and ability to save has not been realised. The explanation for this may be related to several factors related to the measurements used, since increasing commercialisation in relative terms is not equivalent to rising incomes in absolute terms. Moreover, for those households that already ate three meals in the lean season in 2008, food security improvements are not possible – 44 percent of the households reported eating three meals in the lean season already in 2008 and were thus not able to improve their food security in the run-up to 2013. Whereas the former problem is difficult to control for, given the problems of cross-country comparative income data already detailed, the latter can be handled more easily.

To deal with this methodological problem I re-run the food security and saving improvement variables for the commercialisation pathways, this time excluding those households that were food secure already in 2008. For the staple crop, food crop and cash crop variables, no correlations exist between increased commercialisation and improvements in saving or food security, even when sampling only those households that were food insecure in 2008. For animal products, however, there is a small positive association between improved food security (0.066 *) and increased commercialisation in animal products, but none for improved ability to save. Regardless of whether the less food secure households are singled out or not, there is no link between the majority of commercialisation pathways and improvements in food security.

This pattern is clearly counterintuitive and may point to problems with the food security indicator (a point also suggested by the conflicting tendencies for data on grain consumption and meals eaten in the lean season in the case of Tanzania, where the former has risen and the latter has declined). Most obviously, the number of meals eaten in the lean season says nothing about the length of the lean season itself and whether food security is a temporary or more permanent phenomenon. Also, the understanding of the concept of a meal may vary across country as well as regional settings. Using the amount of grain production devoted to home consumption as an alternative food security metric excludes sampling sites where dietary patterns are based largely on roots and tubers, and also those where households rely primarily on purchased foods.

10. CONCLUSIONS

Several trends emerge in the data, in part breaking with earlier tendencies. On the one hand there are slight improvements in food security when measured as grains consumed by the household, with households both on average and in median terms experiencing rising home consumption. This increase has benefited the lower distribution disproportionately, since median consumption rose more than average consumption. In the meantime, more grains are leaving the household for consumption by friends and relatives elsewhere. While the size of grain transfers remained largely unchanged, the share of households involved in such transfers increased quite dramatically, while the reciprocity of transfers was more accentuated. Incoming cash remittances on the whole rose, but especially for households involved in transfers. In general, therefore, the multi-local nature of livelihoods has become more pronounced since 2008.

Using alternative food security indicators – the number of meals eaten in the lean season – also suggests a slight improvement in food security, but these improvements were concentrated in Zambia and Mozambique. Also the ownership of livestock increased throughout the period, but given the extremely skewed ownership of livestock, this is likely to have little impact on the nutritional diversity of households in general.

Regional dynamics of grain consumption are largely related to differences in cropping patterns, whereas differences in amounts of meals consumed during the lean season are most pronounced in Mozambique and Kenya. In general, however, regional disparities in food security are less pronounced than expected given the sampling strategy used.

Gender differences are more manifest: although food security has generally improved for male- and female-headed households, gender gaps have generally widened, and especially so with respect to ownership of livestock.

Pathways to commercialisation are in general not biased against either female-headed households or poorer households, although stagnant commercialisation has a positive correlation with female-household headship. This confirms data from other work showing that commercialisation in general is a strong driver of production. Unfortunately, commercialisation is not linked to improvements in food security (when measured by number of meals eaten during the lean season) or increasing ability to save. In turn, this points to potential problems with the indicators used, but may also suggest that the food security improvements noted for the sample can be explained by non-commercial factors. Improved possibilities for purchasing food – possibly through incomes generated from outside agriculture – may be the source of rising food security in some regions (as noted for Nyeri in Kenya, for example). Rising production of grains and increases in livestock ownership enable withholding food for own consumption in other regions.

While commercialisation is an important driver of production and deserves to be encouraged in this respect, measures for enhancing commercialisation need to be accompanied by interventions that encourage production increases to enhance food security.

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ENDNOTES

1 www.keg.lu.se/en/research/research-projects/current-research-projects/afrint

2 Interviews have been carried out at the household level with the self-identified farm manager. In practice this means that the de facto household head has been interviewed. 29 percent of the farms were managed by a female farm manager in 2013. The terms 'farm manager', 'landholder' and 'household head' are used interchangeably in the text.

3 The following weights have been assigned when calculating adult equivalents: household members aged 15 and below have been given a weight of 0.5, household members above the age of 60 have been given a weight of 0.75. For the 2002 and 2008 data there are many households that stated that the number of household members above the age of 60 was 'uncodeable information'. This creates a large number of missing cases for the number of adult equivalents for 2002 and 2008. In the case of the 2002 data these cases are highly concentrated to Zambia, where 120 households (30 percent of the sample) reported this answer. For 2008, by contrast, all cases except a handful are found in Tanzania, where 66 percent of the cases are missing. This was related to problems with data collection difficulties in Tanzania specifically during the second round of data collection. In 2013, the data entry routines were improved and there were only minor discrepancies – around 40 households were recoded as zero rather than system missing since it was assumed that the enumerators had erroneously skipped the question rather than set it as zero.

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